Foreword

This report titled “Annual Hydrologic Record and Sediment Yield for Gazos Creek above Highway 1, San Mateo County, California: Data Report for Water Year 2002” (Gaging Report) is being included as an appendix in the Gazos Creek Watershed Assessment (GCWA) for several reasons, even though it is written and will be also be released as a separate, stand-alone data report.

1) The GCWA draws integrally upon much of the information in the Gaging Report, so the related observations, data, and analyses should be available to all GCWA readers

2) The sediment-discharge measurements and analyses for Gazos Creek are developed as part of the Gaging Report, because it is logically linked to the streamflow analyses and based in part upon them, but the data need to be available to GCWA readers.

3) The two projects, while funded separately, were both supported by the California Department of Fish and Game, and both projects were managed by the Coastal Watershed Council. The California Coastal Conservancy also funded the Gazos Creek Watershed Assessment and (with the Department and Game) will likely be supporting the enhancement program which will implement recommended measures.

4) The Gaging Report serves, in part, as a baseline to assess future changes in the watershed -- most especially the efficacy of measures to protect baseflows and to reduce sediment transport and sedimentation. As such, it is integral to monitoring the enhancement program and (to the extent discernible) other changes in the watershed.

The Gaging Report will also be available as a separate, stand-alone report under its own cover, with editorial differences, but identical data.

Annual Hydrologic Record and Sediment Yield for Gazos Creek above Highway 1, San Mateo County, California

Data Report for Water Year 2002

Prepared for:

Coastal Watershed Council

Funding provided by:

California Department of Fish and Game

Prepared by:

Jonathan Owens

David Shaw

Barry Hecht

Balance Hydrologics, Inc.

April 2003

A report prepared for:

Coastal Watershed Council
P.O. Box 1459
Santa Cruz, CA 95061
email: cwc_office@yahoo.com
phone: (831) 464-9200

Annual Hydrologic Record and Sediment Yield for Gazos Creek above Highway 1, San Mateo County, California: Data Report for Water Year 2002

Funded by: Department of Fish and Game California Coastal Salmon Recovery Program

Balance Project Assignment 200085

by

Jonathan Owens
Hydrologist

David Shaw
Hydrologist

Barry Hecht, CEG, CHg
Hydrologist/Geomorphologist

Balance Hydrologics, Inc.
841 Folger Ave
Berkeley, CA 94710-2800
(510) 704-1000
office@balancehydro.com

April 13, 2003

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1.0 PROJECT PURPOSE AND INTRODUCTION

The Coastal Watershed Council (CWC) obtained a grant from the California Department of Fish and Game (CDFG) to monitor streamflow in lower Gazos Creek. CWC requested that Balance Hydrologics, Inc. (Balance) monitor streamflow in Gazos Creek upstream of diversions from the creek, and provide that information to the diverters during water year 2002[1]. This report summarizes stream flows and rates of sediment discharge in Gazos Creek. We believe that stream gaging at this site is important to the DFG for the following reasons:

- Streamflow is the basic influence affecting fish habitat and populations, which are CDFG priorities, and only scattered measurements have previously been made on Gazos Creek.

- Providing accessible, real-time streamflow information as a way to manage diversions may be a way to encourage cooperative, error-free and responsible water use by irrigators.

- Streamflow measurements on Gazos Creek can also be used to estimate flows on Gazos Creek tributaries, and can provide a useful baseline and management tool, subject to additional spot measurements to better establish correlations.

- Streamflow is an important parameter in evaluating sediment-transport data, which Balance collected as part of the Gazos Creek Watershed Assessment and Enhancement Plan (funded by CDFG and the State Coastal Conservancy). Bedload-sediment transport rates, especially at moderate to high flows (which move gravels) are an important factor relating to the availability and mobility of spawning gravels for salmonids, as well as habitat-impairing materials.

This data report summarizes our observations, measurements and data analysis for the gage on Gazos Creek during water year 2002. The report:

- briefly describes where and what measurements were made;

- the methods used in making the measurements;

[1] Most hydrologic and geomorphic monitoring occurs for a period defined as a water year, which begins on October 1 and ends on September 30 of the named year. For example, water year 2002 (WY2002) began on Oct. 1, 2001, and concluded on September 30, 2002.

- summarizes the results of these measurements;
- reports daily streamflows in Gazos Creek during water year 2002; and
- develops estimates of bedload-sediment and suspended-sediment discharges for Gazos Creek during water year 2002

Streamflow measurements for this project are jointly used as a component of the Gazos Creek Watershed Assessment and Enhancement Plan, managed by the Coastal Watershed Council. Ongoing stream gaging is also important for evaluating the performance and effectiveness of restoration measures that are being carried out in the watershed to improve habitat conditions for coho and steelhead. Although not technically part of this telemetered stream gaging project, sediment-discharge measurements are presented here as a component of the Watershed Assessment and Enhancement Plan (see Foreword).

Real-time data availability, flow measurements and monitoring continued into water year 2003.

2.0 STATION DESCRIPTION: GAZOS CREEK ABOVE HIGHWAY 1

Balance Hydrologics and CWC staff established a standard open-channel flow stream gage located on Gazos Creek, approximately one-half mile upstream from Highway 1, and about one-quarter mile upstream of the pump-station diversion. A small site map illustrating the location of the stream gage relative to the pump-station diversion can be found in Form 1. The total watershed area above the mouth is 11.4 square miles, while the area above the gaging station is approximately 11.3 square miles (measured from maps by Balance staff). Gazos Creek discharges directly into the Pacific Ocean. The rainfall pattern across the watershed is highly orographic, with the coast averaging about 22 inches per year and the higher elevations averaging about 45 inches per year (Rantz, 1971). Measurements of water levels, streamflow, specific conductance, and bedload sediment have been made at this site since the spring of 2001 when a staff plate was installed. Balance staff installed an automatic water level recorder on October 2, 2001. Real-time web data became available in March 2002.

3.0 HYDROLOGIC SUMMARY

3.1 Gazos Creek

We collected a continuous record of water level for the entire water year. Daily flows are presented in Form 1 and are presented as a hydrograph of daily flows in Figure 1. Summer baseflows at the start of the water year were, as expected, at a minimum level. Small amounts of rain fell during October and November 2001. Heavy rains began in late November, continuing through December 2001, into the very beginning of January 2002. The rest of the winter was one of clear weather, punctuated by a few light rains. The last rain was in mid May, followed by typical spring and summer baseflow conditions.

Streamflow in Gazos Creek totaled approximately 8,650 acre-feet during water year 2002. The highest water levels and flow rates occurred December 2, 2001; the peak flow that we calculated for that day was 933 cubic feet per second (cfs) at 8:45 hours. Figure 1 and Form 1 document daily flow for the water year. Figure 2 documents the flow data at 15-minute intervals. Figure 9 displays the daily data represented as exceedance probabilities.

3.2 Comparisons to other Watersheds

Additional comparisons were made to other creeks for validation purposes. We compared the Gazos Creek data to flow measured in a similar-sized watershed: Corte Madera Creek in Portola Valley, on the east side of the Santa Cruz Mountains, where continuous gaging commenced in 1996. Corte Madera Creek has a drainage area of 6.0 square miles, and an average annual rainfall of about 30 inches (Rantz, 1971). The Corte Madera Creek record provides an independent data set for comparison and validation (Owens, Brown, and Hecht, 2002). Hydrographs for the two creeks are plotted in Figure 3. The figure illustrates several key attributes of the hydrology of Gazos Creek:

- Gazos Creek has significantly higher baseflows that streams of generally-similar size in the region, especially during late summer;

- Peak flows in Gazos Creek are not as peaked or flashy as in other nearby watersheds, measured relative to interstorm winter baseflow, suggesting more and more rapid infiltration during storms, providing recharge to sustain baseflow;

• Perhaps not surprisingly, Gazos Creek reaches a sustained winter baseflow earlier during the winter than Corte Madera (and other) similar-sized watersheds, probably also reflecting greater rates of infiltration during storms; during water year 2002, winter baseflow in Gazos Creek attained typical levels with the December 2 storm, whereas Corte Madera Creek did not reach full interstorm baseflow until the January 3 event.[2]

Both records show responses to the same storms and heat spells or foggy periods during summer. Each storm is reflected in the record from both gages, imparting validity to both records.

One of the likely reasons for high and sustained baseflows in Gazos Creek is the geologic structure underlying the watershed. Much of the drainage basin has developed in flat-lying or gently-dipping fractured mudstones of the Santa Cruz formation (Brabb, 1970), which affects not only its infiltration and summer-flow attributes, but also the stability of its bed and banks, water quality, and resilience to wildfires and other watershed-scale disturbances (Hecht and Rusmore, 1973; Hecht, 1998).

Balance also operated a stream gage on Whitehouse Creek for a portion of water year 2002. Whitehouse Creek is the next watershed to the south of Gazos Creek, receives similar rainfall, and has similar predominant bedrock (Santa Cruz mudstone); both Whitehouse and Gazos Creeks have high baseflow compared to other regional creeks. We anticipate presenting these data as part of a subsequent study sponsored by others.

4.0 DEVELOPING A STREAMFLOW RECORD

Our streamflow record is based on two sets of data: 1) field data from direct observations and measurements made approximately monthly or during storm runoff events, and 2) datalogger and pressure-transducer automated record of water levels.

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2 One ramification is that Gazos Creek is able to sustain high winter baseflows earlier throughout spawning periods important to coho, and can sustain higher baseflows during mid-winter droughts which may affect coho spawning or incubation.

Step one of the data processing is to create a stage record from the pressure transducer data (stage is the water level as read against the staff plate). The automated record is checked and corrected to match our observations and measurements, including high-water marks. Step two is to convert the stage record to flow; this is done by creating an empirical stage-to-discharge relationship, also referred to as a stage-discharge “rating curve”. The rating curve is based on our periodic site staff-plate readings (stage) and flow measurements (see Table 1). The rating curve can also be presented in table form (Table 4), as will be covered later in this report (section 7.2). The rating curve is used to convert stage data to flow data.

The flow record is presented in Figures 1 and 2; the stage record is presented in Figures 4 and 5. During this year, as is typically done, we applied multiple stage shifts to account for changing conditions, such as log jams and local scour and fill.

Large peak flows can be estimated based on a conventional extension of the rating curve, however, we also performed a cross-sectional survey of the creek channel and floodplain which included high-water marks from the winter’s peak flows. The surveyed high-water marks coincided with the peaks recorded by the datalogger. Using the surveyed cross-sectional areas and extrapolated velocities, we calculated gaged estimates of the peak flow for the water year. As with all other open-channel gaging of natural streams, uncertainty remains (especially at high flows) in spite of efforts to be as precise as possible. We believe that the gaged peak flow of 933 cfs for Gazos Creek, during water year 2002, is within 10 to 15 percent of the actual peak flow, consistent with hydrologic norms in the region.

Most of our results are presented as mean daily flow, averaged from data collected and calculated every 15 minutes. Upon request, the more detailed, 15-minute record can be made available for specific periods of interest.

5.0 TEMPERATURE AND SPECIFIC CONDUCTANCE

In addition to water level, we operated a temperature and specific conductance probe at the gaging site. The probe record was calibrated to measurements that we made with hand-held meters; the hand-held meters were calibrated to solution standards. Manual measurements are presented in Table 1; the data are graphed in Figure 6.

5.1 Temperature

Temperature strongly affects both steelhead and coho habitat suitability. We recorded temperature continuously at this site during WY2002. Water temperatures recorded by the continuous gage on Gazos Creek are, not surprisingly, higher in summer (beginning in mid-May) than they are in the winter (Figures 6 and 7). The maximum recorded temperature at this station was 19.1°C on July 9, 2002. Water temperatures in Gazos Creek tend to be lower than in other Santa Cruz Mountains streams. Higher baseflows, shading by riparian vegetation, and coastal weather influences all help maintain modulated temperatures.

5.2 Specific Conductance

Specific conductance, a widely used index for salinity, was measured in the field and recorded at field temperatures, then later converted to an equivalent value at 25°C according to the accepted relationship between specific conductance and temperature. The expected range of specific conductance in Gazos Creek is from about 100 to 500 µmhos/cm, corrected to 25°C. The lowest levels occur during storm runoff, when flows are diluted with rain water. In general, specific conductance levels in Gazos Creek follow an expected pattern with higher specific conductance (higher salinity) at low flows and lower levels occurring during storm events (Figures 6 and 7). The highest values during this water year, as typical, occur during late summer and early fall; the highest values are around or slightly over 400 µmhos/cm, corrected to 25°C. This peak value is low compared to those measured in many other regional streams, meaning that Gazos water has lower mineral content (fresher) than many other creeks.

6.0 SEDIMENT TRANSPORT

Although sediment-transport monitoring was not part of the stated scope of this project, sediment monitoring seems to us to be an important part of a project being done in tandem as part of a watershed assessment.[3] Balance staff therefore measured sediment in transport during storms at the GCDFG gage and other stations in the watershed, in conjunction with

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[3] Measuring sediment discharge in the lower reach of Gazos Creek can be especially significant as part of a broader effort to understand the sources and transport of sediment within the Gazos Creek watershed as a whole. The data help in supporting steps to make water supply as compatible as possible with other watershed values and functions.

CWC measurements of sediment transport and turbidity at low flow. The sediment data are presented here, but most of the analysis and discussion of the data will be presented in the Gazos Creek Watershed Assessment and Enhancement Plan (CWC, 2003).

6.1 Types of sediment transport

We distinguish two types of sediment in transport. Bedload sediment is supported by the bed; it rolls and saltates along the bed, commonly within the lowermost 3 inches. Movement can be either continuous or intermittent, but is generally much slower than the mean velocity of the stream. In Gazos Creek, bedload consists primarily of gravels and medium-to-coarse sands (greater than 0.25 mm) and gravels. Suspended sediment is supported by the turbulence of the water, and is transported at a rate approaching the mean velocity of flow. In Gazos Creek, as elsewhere, suspended sediment consists of fine sands, silts, and clays.

6.2 Sediment rating curves

Balance's sediment measurements are detailed in Table 2 and plotted in Figure 8. We also chose to use these curves to estimate sediment yield from the Gazos Creek basin during water year 2002. Sediment discharge was calculated at 15-minute intervals based on the flow record; daily totals were then computed from the 15-minute data. The principal purpose of the sediment sampling is to develop an empirical relationship of the amount of sediment transported at a given flow. In Figure 8, the location of the plotted rating curves is an indicator of the mobility of sediment for the period that a curve represents. The further to the right the rating curve plots on Figure 8, the lower sediment delivery is, at a given flow. Note how far to the left the data from Old Womans Creek plot.

Over the last year, the curves may have migrated toward lower rates of transport past our station, indicating that yields may have decreased- - suggesting that the creek may be recovering from the large influx of sediment during water year 1998.

We caution that given the limited number of data points, sediment totals for the year should only be considered approximate. Yearly and monthly estimates of sediment discharge are presented in Form 2.

6.3 Scour and Fill of Pool Habitat

In other regional creeks, we have observed that flows exceeding approximately seven tenths of the bankfull flow tend to scour pools, while flows smaller than 0.6 to 0.7 of the bankfull flow tend to fill pools. Depending on the size and timing of storms through a season, flow information can help predict whether pool habitat is improving (being scoured) or being filled. At our gaging location on Gazos Creek, we estimate morphological bankfull flow as approximately 850 cfs; the breakpoint between scouring and filling of the pools is therefore approximately 510 to 600 cfs at this location.

During water year 2002, this model predicts that only the largest storm on December 2, 2001 contributed to scouring pools, while the remainder of the storms that generated enough flow to transport bedload sediment would have mainly contributed to pool filling.

7.0 DATA ACCESSIBILITY BY WATER USERS

One of the purposes of this project was to provide streamflow data to Gazos Creek water users, in order to allow them to better manage their water withdrawals from the creek. Real-time data access is available for water users, by contacting Marty Gingras at the California Department of Fish and Game. During water year 2002, Balance staff led a meeting to explain to the water users how to access the stream data, how to interpret the data, how the data are processed, and how measurements are made.

7.1 Website data

Website data can be an effective tool for providing estimates of flow in *near* real time that can provide diverters with information to better plan pumping from the stream within regulatory limits. As part of this study, Balance staff have been able provide the Department of Fish and Game and its cooperators with such data. Access is provided through www.balancehydro.com, by clicking on the "real-time data" button. The data are password protected. User names and passwords were provided to water users. The website provides graphic and tabular data, and provides data at 15-minute intervals as well as daily averages.

The datalogger saves data every 15 minutes, and then data are transferred to the website every two hours. Beyond the time delay, uncertainty in the data can originate from numerous sources, even when the data are freshly calibrated with manual measurements. This uncertainty should be recognized, and included in any decisions made using the data. We estimate that the uncertainty of the data is about 10 percent of the value that might be measured if a hydrographer were onsite, providing fresh measurements every two hours. Nonetheless, we believe that real-time data can be a new tool and useful aid in deciding when and how much to divert within pre-set limits.

7.2 Telephone data

In addition to website access, the data are also accessible by telephone. Calling the phone number for the datalogger activates an electronic voice synthesizer that communicates the current stream data to the caller. The voice synthesizer communicates stage values, which can then be converted to flow by the water user with the use of the current stage-discharge rating table (see Table 4). The stated stage is used to look up the value of flow; the last digit of stage is read across in the appropriate column. For example: using Table 4, and a stated stage of 1.27 feet (read down to “1.2” and then across to “0.07”), the resulting flow would be 6.06 cfs. The stage-discharge relationship for this stream-gaging location is relatively stable during a given summer season, but does shift occasionally, so it is important to use the most current rating table. Updated tables are provided after we detect and adjust for changed conditions in the creek (such as the formation of a wood jam).

Some of the uncertainty in the data can be assessed from the telephone data, because the readings from each of the pressure transducers are given; the two values can be compared. If the two values agree, then uncertainty is probably lower than if the two values disagree.

8.0 FUTURE MONITORING

Balance is currently continuing stream gaging on Gazos Creek for the first part of water year 2003. As we collect more data, comparisons to previous years help put the data in better perspective; we also gain a better understanding of how these measured years relate to the long-term record.

Please contact us if you can contribute any observations or measurements, suggest revisions, or have questions concerning this work.

9.0 REFERENCES

Coastal Watershed Council, 2003. Gazos Creek Watershed Assessment and Enhancement Plan. In preparation: consulting report for State Coastal Conservancy and California Department of Fish and Game, managed by the Coastal Watershed Council. April.

Hecht, B., and Rusmore, B., eds., 1973, Waddell Creek -- the environment around Big Basin: Sempervirens Fund and the University of California, Santa Cruz, 98 p. + appendix

Hem, J.D., 1985, Study and interpretation of the chemical characteristics of water, USGS Water Supply Paper 2254, 264 p.

Owens, J., Brown, S. and Hecht, B., 2002. Annual hydrologic record and sediment yield for Corte Madera Creek, Portola Valley, California: data report for water year 2002. Draft consulting report for Stanford University Facilities Department, November.

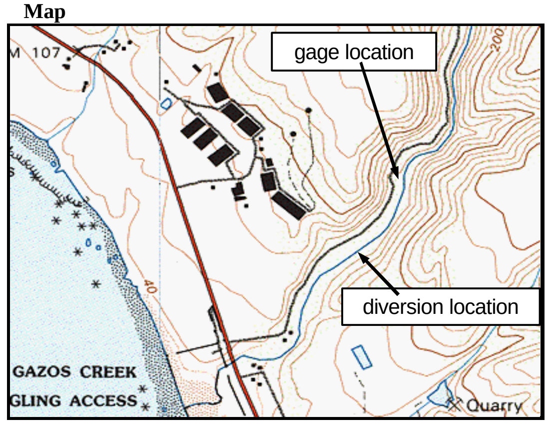
Rantz, S.E., 1971, Precipitation depth-duration-frequency relations for the San Francisco Bay Region, California, U.S. Geological Survey Open-file Report 3019-12, 7 p. + map and tables

ANNUAL SUMMARY FORMS

Water Year:	2002
Stream:	Gazos Creek
Station:	above Highway 1
County:	San Mateo, CA

Form 1. Annual Hydrologic Record

Map



Station Location / Watershed Descriptors

Latitude: 37 10' 17", Longitude: 122 21' 18". Gage is located on north side of creek, about 0.5 miles upstream of Highway 1. Land use includes mainly forested open space, some forestry activities, and a few low-density residences. Drainage area upstream of gage is 11.3 square miles.

Mean Annual Flow

Mean annual flow (MAF) for WY 2002 was 12.0 cubic feet per second (cfs).
For comparison purposes, rainfall in WY 2002 was fairly close to average annual precipitation.

Peak Flows

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
11/12/2001	11:00	1.86	61	12/21/2001	5:15	2.94	133
11/29/2001	2:30	4.17	410	12/22/2001	13:15	2.86	124
12/2/2001	8:45	6.27	933	12/31/2001	4:00	2.58	93
12/14/2001	3:15	2.46	79	1/2/2002	12:15	4.83	481

Peak for Period of Record (Oct. 2 to Sept. 30, 2002): 933 cfs on Dec. 2, 2001.

Period of Record

Staff plate installed February 2001, water-level recorder installed 10/2/01. Gaging funded by Department of Fish and Game, California Coastal Salmon Recovery Program.

WY 2002 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.87	1.27	45.77	52.44	9.93	10.80	8.66	5.05	3.35	2.22	1.56	1.27
2	0.87	1.17	392.28	304.31	9.56	10.11	8.33	4.83	3.36	2.18	1.78	1.18
3	0.96	1.16	115.25	160.86	9.14	9.54	8.09	4.76	3.33	2.18	1.90	1.20
4	0.99	1.13	66.45	90.92	8.78	9.16	7.99	4.65	3.23	2.16	1.77	1.18
5	1.00	1.09	45.04	62.97	8.47	8.86	7.75	4.56	3.17	2.11	1.66	1.10
6	0.98	1.04	34.81	50.62	8.18	11.05	7.62	4.44	3.08	2.10	1.59	1.11
7	1.00	1.07	29.25	42.07	12.20	15.61	7.47	4.35	2.97	2.06	1.57	1.15
8	0.94	1.07	25.76	36.29	20.86	14.32	7.23	4.26	2.90	2.16	1.49	1.14
9	0.99	1.07	24.58	31.73	14.91	12.06	7.13	4.18	2.69	2.06	1.41	1.07
10	0.97	2.03	22.20	28.18	12.79	15.16	7.13	4.14	2.72	2.01	1.38	1.04
11	0.94	5.76	20.31	25.00	11.53	13.42	6.81	4.08	2.70	2.01	1.41	1.07
12	0.91	22.45	18.73	22.85	10.80	12.33	6.60	3.99	2.71	2.04	1.39	1.10
13	0.86	5.82	17.63	21.16	10.20	11.52	6.21	3.90	2.75	2.01	1.45	1.11
14	0.85	3.13	38.95	19.69	9.70	10.90	6.25	3.94	2.85	1.96	1.44	1.09
15	0.86	2.49	25.14	18.49	9.15	10.37	6.04	3.96	2.76	1.94	1.42	1.04
16	0.90	2.15	21.16	17.43	10.14	9.86	5.94	3.87	2.71	2.00	1.47	1.04
17	0.91	1.96	25.93	16.44	17.45	13.03	6.40	3.80	2.64	2.01	1.45	1.03
18	0.94	1.79	24.19	15.28	13.63	11.09	5.73	3.73	2.67	1.95	1.43	1.04
19	0.96	1.70	23.80	14.45	16.56	10.00	5.58	4.93	2.65	1.95	1.49	0.96
20	0.89	1.68	66.26	13.72	25.52	9.51	5.52	4.57	2.65	1.95	1.49	0.91
21	0.87	1.73	97.99	13.32	22.33	9.06	5.47	4.32	2.79	1.89	1.33	0.91
22	0.87	2.45	76.93	12.59	19.41	10.56	5.20	3.99	2.99	1.84	1.33	0.93
23	0.88	1.91	66.21	11.78	17.33	14.16	5.23	3.84	2.86	1.81	1.39	0.96
24	0.86	9.20	47.04	11.22	15.73	14.05	5.26	3.76	2.73	1.75	1.41	0.89
25	0.81	5.82	35.91	10.89	14.44	12.95	5.19	3.69	2.65	1.72	1.34	0.88
26	0.82	3.78	29.88	12.81	13.29	12.04	5.15	3.66	2.62	1.74	1.28	0.94
27	0.86	2.97	25.38	11.90	12.36	11.19	5.18	3.62	2.63	1.76	1.24	1.02
28	0.88	10.45	27.90	13.05	11.58	10.24	4.90	3.57	2.57	1.59	1.33	1.05
29	0.86	123.48	34.82	12.04		9.74	4.95	3.54	2.53	1.54	1.37	1.02
30	2.54	22.90	47.68	10.99		9.40	5.00	3.48	2.33	1.56	1.36	1.02
31	1.87		73.28	10.40		8.77		3.37		1.55	1.33	
MEAN	0.99	8.19	53.11	37.93	13.43	11.32	6.33	4.09	2.82	1.93	1.46	1.05
MAX. DAY	2.54	123.48	392.28	304.31	25.52	15.61	8.66	5.05	3.36	2.22	1.90	1.27
MIN. DAY	0.81	1.04	17.63	10.40	8.18	8.77	4.90	3.37	2.33	1.54	1.24	0.88
cfs days	30.72	245.71	1646.52	1175.89	375.98	350.83	190.00	126.83	84.57	59.79	45.27	31.43
ac-ft	60.93	487.36	3265.87	2332.38	745.76	695.88	376.87	251.56	167.74	118.60	89.79	62.35

Monitor's Comments

1. Continuous water-level record for all days starting 10/2/02; flow for 10/1/01 assumed to be the same as 10/2/01.
2. Multiple stage shifts were applied to the rating equation. Stage shifts adjust for local scour and fill in addition to water-level changes due to algae growth, or leaf and debris jams.
3. A large log and debris jam formed on or about Dec. 2, 2001. Adjustments to the record were made to account for the backwater effects associated with the log jam.
4. Peak values were estimated by using a surveyed stream cross section and high-water marks.
5. Values with more than 2 to 3 significant figures result from electronic calculations. No additional precision is implied.

Water Year 2002 Totals:		
Mean annual flow	**12.0**	(cfs)
Max. daily flow	**392**	(cfs)
Min. daily flow	**0.81**	(cfs)
Annual total	**4364**	(cfs-days)
Annual total	**8655**	(ac-ft)

Water Year:	2002
Stream:	Gazos Creek
Station:	0.5 miles upstream from mouth
County:	San Mateo County, CA

Form 2. Annual Sediment-Discharge Record

WY 2002 Daily Suspended-Sediment Discharge *(tons)*

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	Qss Annual
1	0.0	0.0	68.2	29.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	1875.6	1260.6	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	282.4	499.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
4	0.0	0.0	61.8	160.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
5	0.0	0.0	18.7	50.7	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
6	0.0	0.0	8.6	26.2	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	
7	0.0	0.0	5.0	15.0	0.7	0.9	0.1	0.0	0.0	0.0	0.0	0.0	
8	0.0	0.0	3.4	9.6	2.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	
9	0.0	0.0	3.0	6.4	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	
10	0.0	0.0	2.2	4.5	0.4	0.7	0.1	0.0	0.0	0.0	0.0	0.0	
11	0.0	0.1	1.7	3.1	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	
12	0.0	7.3	1.3	2.4	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	
13	0.0	0.1	1.1	1.9	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
14	0.0	0.0	15.7	1.5	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
15	0.0	0.0	3.2	1.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
16	0.0	0.0	1.9	1.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
17	0.0	0.0	3.8	0.9	1.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	
18	0.0	0.0	2.8	0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
19	0.0	0.0	3.1	0.6	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
20	0.0	0.0	82.3	0.5	3.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
21	0.0	0.0	200.2	0.5	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
22	0.0	0.0	105.4	0.4	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
23	0.0	0.0	60.0	0.3	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.3	21.3	0.3	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.0	9.4	0.3	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	
26	0.0	0.0	5.4	0.4	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
27	0.0	0.0	3.3	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	
28	0.0	15.9	4.6	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
29	0.0	365.2	8.9	0.4		0.2	0.0	0.0	0.0	0.0	0.0	0.0	
30	0.0	2.7	31.3	0.3		0.2	0.0	0.0	0.0	0.0	0.0	0.0	
31	0.0		83.2	0.2		0.1		0.0		0.0	0.0		
TOTAL	0	392	2979	2079	19	10	2	0	0	0	0	0	**5,481**
Max.day	0	365	1876	1261	3	1	0	0	0	0	0	0	**1,876**

WY 2002 Daily Bedload-Sediment Discharge *(tons)*

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	Qbed Annual
1	0.0	0.0	81.7	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	1373.0	1045.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	346.6	563.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4	0.0	0.0	54.0	192.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5	0.0	0.0	10.8	40.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
6	0.0	0.0	3.8	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
7	0.0	0.0	1.8	7.9	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
8	0.0	0.0	1.1	4.4	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
9	0.0	0.0	0.9	2.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
10	0.0	0.0	0.6	1.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
11	0.0	0.0	0.4	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
12	0.0	4.5	0.3	0.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
13	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
14	0.0	0.0	10.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17	0.0	0.0	1.4	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
18	0.0	0.0	0.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19	0.0	0.0	1.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
20	0.0	0.0	89.2	0.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
21	0.0	0.0	244.7	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
22	0.0	0.0	114.7	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
23	0.0	0.0	51.3	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.1	12.8	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.0	4.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
26	0.0	0.0	2.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
27	0.0	0.0	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
28	0.0	18.4	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
29	0.0	331.8	4.0	0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
30	0.0	0.9	26.6	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
31	0.0		80.5	0.0		0.0		0.0		0.0	0.0		
TOTAL	0	356	2523	1899	5	2	0	0	0	0	0	0	**4,784**
Max.day	0	332	1373	1046	1	0	0	0	0	0	0	0	**1,373**

Daily values are based on calculations of sediment discharge at 15-minute intervals.
Multiple sediment-discharge rating curves were used for different periods of the year and ranges of flow.
Daily values with more than 2 to 3 significant figures result from electronic calculations. No additional precision is implied.

Total annual sediment discharge (suspended- plus bedload-sediment discharge)
WY 2002: 10,265 ***tons***

Balance Hydrologics, Inc. 900 Modoc Street, Berkeley, CA 94707 (510) 527-0727; fax: (510) 527-8532

TABLES

Table 1. Station Observer Log:
Gazos Creek above Highway 1, water year 2002

Site Conditions				Streamflow				Water Quality Observations				High-Water Marks		Remarks
Date/Time	Observer(s)	Stage	Hydrograph	Measured Discharge	Estimated Discharge	Instrument Used	Estimated Accuracy	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C	Additional sampling?	Estimated stage at staff plate	Inferred dates?	
(mm/dd/yr)		*(feet)*	*(R/F/S/B)*	*(cfs)*	*(cfs)*	*(AA/PY)*	*(e/g/f/p)*	*(oC)*	*(µmhos/cm)*	*(at 25 oC)*	*(Qbed, etc.)*	*(feet)*	*(mm/dd/yr)*	
Gazos Creek above Highway 1, upstream of diversions (Site e.)														
9/18/01 14:00	sds	0.65	B	0.99	…	PY	p	14.1	301	387	…	…	…	Disturbed control at d/s end of pool
10/2/01 15:40	jo, bjm	0.635	B	…	0.5 to 0.7	est.	p	16.4	318	385	…	…	…	installed datalogger; 2 crayfish in pool, bank
10/19/01 9:50	sds, cw	0.64	B	0.96	…	PY	e	11.4	252	348	…	…	…	sediment source + LWD inventory today
11/15/01 17:30	sds	0.78	B	2.40	…	PY	g	12.5	283	380	…	…	…	3 days after 1st major storm of year
11/29/01 7:45	sds, bjm	2.42	F	112	…	AA	g	…	…	…	Qss, Qbed	4.15	11/29/01	fesh sediment deposits on bank 100' d/s of gage
11/29/01 10:45	sds, bjm	2.03	F	77.3	…	AA	f	…	…	…	Qss, Qbed	…	…	log jams moving upstream; fallen tree 80' d/s of gage
12/2/01 17:20	sds, cw	3.6	F	262	…	AA	g	12.5	118	159	Qss, Qbed	…	…	showers after major storm; observations at Hwy 1 also
12/14/01 9:00	jo	2.04	F	42.3	…	AA	e-g	11.5	183	252	Qss, Qbed	…	…	water light brown, visibility 2"
12/21/01 11:45	jo, mtc	2.6	F	…	100	est.	p	…	…	…	Qss, Qbed	…	…	rain last night; volunteer Q meas. upstream
12/28/01 17:15	sds, bjm	1.82	U	32.4	…	AA	f	…	…	…	Qss, Qbed	…	…	possible ponding from lwd d/s of gage; flow measured at pump station clearing
1/2/02 16:00	sds, jo	4.9	R, F	…	525	est.	p	13	113	150	Qss	…	…	GH = 5.5 u/s of staff tree, 4.9 d/s; too deep to wade
1/11/02 15:12	jo	1.76	B	24.97	…	AA	g-f	11.2	192	267	Qss, Qbed	5.15,6.2	WY02	light turbidity; light grey-green color
1/17/02 15:57	jo, ch, smc	1.59	B	16.80	…	AA	g-f	9.2	198	290	…	multiple	multiple	sand grains eddying behind rocks; slight turbidity; surveyed cross section and HWMs
2/13/02 10:45	jo	1.44	B	10.10	…	AA	g	9.2	213	312	…	…	…	water mostly clear; sand grains dancing in lee of rocks
2/21/02 15:55	sds	1.64	B	22.35	…	AA	g	12.5	191	256	Qss?	…	…	water slightly cloudy; minor bedload moving; cleaned transducers
3/8/02 9:50	jo	1.51	F	…	10 to 15	est.	p	…	…	…	…	…	…	rain yesterday morning; installed modem and surge protector
3/27/02 16:42	sb, sds	1.45	B	11.23	…	AA	g	12.5	215	289	…	4.4	…	HWM is vegetation on staff
4/23/02 17:45	jo	1.25	B	5.47	…	PY	g	13.2	249	328	…	…	…	water clear; algae stabilizing sand on the bed
5/9/02 17:46	smc	1.20	B	4.13	…	PY	e	13.8	262	340	…	…	…	sunny, fog rolling in
6/11/02 10:10	jo, smc	1.12	B	2.73	…	PY	g	13.4	292	383	…	…	…	water clear; dead alder branches in the creek; many clumps of gummed-together sand grains
7/16/02 16:23	jo	1.07	B	2.02	…	PY	g	15.2	297	371	…	…	…	water clear, foggy day
7/24/02 9:40	jo	1.06	B	1.89	…	PY	f,g	12.7	295	394	…	…	…	water clear, quick meas. before meeting
8/20/02 20:00	jo	1.02	B	1.36	…	PY	f,g	16.9	282	337	…	…	…	water clear; leaves on bars; recent road maintenance
9/26/02 19:00	jo, smc	1.00	B	0.94	…	PY	g	14.6	305	387	…	…	…	SC probe had been removed from stilling well; cleaned SC probe
10/23/02 11:40	jo	1.02	B	1.24	…	PY	f, g	12.2	303	410	…	…	…	water clear; algae on bed making creek look sedimented; SC probe partially removed

Notes:

Observer Key: jo = Jonathan Owens; bh = Barry Hecht; gp = Gustavo Porras; cw = Chris White; eb=Ed Ballman; sds = Dave Shaw; bm = Bonnie Mallory; sb = Scott Brown; and smc = Shawn Chartrand

Stage: Water level observed at outside staff plate, Department of Fish and Game gage located upstream of Highway 1 about 0.5 miles

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type") current meter. If estimated, from rating curve (R) or visual (V).

Estimated measurejfent accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given

High-water mark (HWM): Measured or estimated at location of the staff plate

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Table 2. Sediment transport measurements:
Gazos Creek above Highway 1, water year 2002

	Site Conditions					Bedload Sampling Details						Sediment Transport			
Sample Date:Time	Observer(s)	Gage Height	Streamflow Discharge	Streamflow Value Source	Stream Condition	Active Bed Width	Sampler Width	No. of Verts.	Time/Vert.	Total Time	Sample Dry Weight	Bedload Discharge	Bedload Discharge	Suspended Sediment Concentration	Suspended Sediment Discharge
		(ft)	*(cfs)*	*M,R,E*	*R,F,B,U*	*(ft)*	*(ft)*		*(sec)*	*(sec)*	*(gm)*	*(lb/sec)*	*(tons/day)*	*(mg/l)*	*(tons/day)*
Gazos Creek Fish and Game Gage (0.5 miles upstream from mouth)															
3/4/01 12:30	jo, cw	-	30	E	R	bedload not measured						…	…	1500	121
11/29/01 7:45	bjm, sds	2.41	112	M	F	30	0.25	3	30	90	2277.9	6.70	281	830	250
11/29/01 10:35	bjm, sds	2.03	77.3	M	F	30	0.25	5	30	150	347.5	0.61	26	530	110
12/2/01 17:10	sds, cw	3.7	260	M	F	27	0.25	5	30	150	1214.9	1.93	81	1400	982
12/14/01 8:00	jo	2.04	42.3	M	F	15	0.25	7	20	140	717.5	0.68	28	300	34
12/21/01 11:50	jo, mtc	2.60	98	R	F	20.0	0.25	4	15	60	1500.0	4.41	185	580	153
12/28/01 17:00	sds, bjm	1.82	32.4	M	U	14.0	0.25	5	30	150	613.4	0.50	21.2	…	…
12/28/01 17:30	sds, bjm	1.82	32.4	M	U	14.0	0.25	5	30	150	597.5	0.49	20.6	61	5.3
1/2/02 15:55	sds, jo	4.90	525	E	P	bedload not measured, too deep and fast to wade						…	…	1,760	2492
1/11/02 15:12	jo	1.76	25.0	M	B	8.0	0.25	6	60	360	120.8	0.02	1.0	21	1.4
1/17/02 15:57	jo, ch, smc	1.59	16.8	M	B	sand grains dancing, but too little to measure						…	0.01	…	…
2/13/02 10:45	jo	1.44	10.1	M	B	sand grains dancing, but too little to measure						…	0.01	…	…

Notes and explanations:
Observers: bh= Barry Hecht; jo= Jonathan Owens; gp= Gustavo Porras; cw= Chris White; sds= David Shaw; bjm= Bonnie Mallory; smc= Shawn Chartrand, ch = Charlotte Hedlund
Streamflow Value Source: M = measured; R = rating curve; E = estimated
Stream Condition: R = rising, F = falling, P = peak, B = baseflow, U = uncertain
Values for bedload and suspended load discharge having more than two to three digits displayed are the result of calculations, increased precision is not implied.
Streamflow discharge is the measured or estimated instantaneous flow when sediment was sampled, and usually differs from the mean flow for the day.
Active Bed Width: The width thought by the field observer to be transporting significant amounts of bedload
Sampler Width and Type: 0.25 = 3-inch Helley Smith; 0.50 = 6-inch Helley Smith
Bedload Discharge (lbs/sec) = [active bed width (ft) * sample dry weight (gm) * 0.002205 (lbs)]/ [sampler width (ft) * sampling time (sec)]
Bedload Discharge (tons/day) = [active bed width (ft) * sample dry weight (gm) * 86,400 (sec)]/ [sampler width (ft) * sampling time (sec) * 907,200 (gm)]
Sample Dry Weights in parentheses are temporary Wet Weights w/plastic bags
Observations of no bedload in motion are given a value of 0.01 tons per day so they can be plotted as threshold data.
Some early and late-season suspended-sediment samples can be reported below the detection limit of 5 mg/l; in those cases, the detection limit has been converted to tons/day so that it can be pl

Table 3. Sediment rating curve equations for specific ranges of flow: Gazos Creek above Highway 1, water year 2002

Start Date, Time	End Date, Time	Low-flow Rating Equation *(tons/day)*	Low-High break point *(cfs)*	HIgh-flow Rating equation *(tons/day)*
Suspended-sediment rating curve				
10/2/2001	9/30/2002	$0.0002*Q^3$	120	$0.4*Q^{1.4}$
Bedload-sediment rating curve				
10/2/2001	9/30/2002	$0.0000025*Q^4$	110	$3.5*Q^{1.0}$

Notes:
A "rating curve" is an equation used to calculate the amount of sediment transported by a given flow.
"Q" is the instantaneous flow rate of Gazos Creek.
Values of calculated sediment discharge are in units of tons per day.
Sometimes we observe and measure higher or lower rates of sediment discharge during certain periods of the water year;
to account for this we may use different curves and equations for different periods.

Table 4. Provisional stage-to-discharge rating table:
Gazos Creek above Highway 1.
San Mateo County, California
(updated 7/22/02, stage in feet, discharge in cfs)

Balance Hydrologics, Inc.

Stage *(feet)*	**0.00** *(feet)*	**0.01** *(feet)*	**0.02** *(feet)*	**0.03** *(feet)*	**0.04** *(feet)*	**0.05** *(feet)*	**0.06** *(feet)*	**0.07** *(feet)*	**0.08** *(feet)*	**0.09** *(feet)*
0.9			0.23	0.33	0.42	0.52	0.63	0.74	0.85	0.96
1.0	1.08	1.21	1.33	1.47	1.60	1.74	1.88	2.03	2.19	2.34
1.1	2.50	2.67	2.84	3.02	3.20	3.38	3.57	3.77	3.96	4.17
1.2	4.38	4.59	4.82	5.04	5.27	5.51	5.76	6.06	6.36	6.68
1.3	7.00	7.33	7.67	8.01	8.37	8.73	9.09	9.47	9.85	10.24
1.4	10.64	11.05	11.46	11.88	12.30	12.74	13.17	13.62	14.07	14.53
1.5	15.00	15.47	15.95	16.43	16.93	17.42	17.93	18.44	18.95	19.47
1.6	20.00	20.54	21.07	21.62	22.17	22.73	23.29	23.86	24.43	25.01
1.7	25.6	26.2	26.8	27.4	28.0	28.6	29.2	29.8	30.5	31.1
1.8	31.8	32.4	33.0	33.7	34.4	35.0	35.7	36.4	37.1	37.7
1.9	38.4	39.1	39.8	40.5	41.2	42.0	42.7	43.4	44.1	44.9
2.0	45.6	46.4	47.1	47.9	48.6	49.4	50.2	50.9	51.7	52.5
2.1	53.3	54.1	54.9	55.7	56.5	57.3	58.1	59.0	59.8	60.6
2.2	61.5	62.3	63.2	64.0	64.9	65.8	66.6	67.5	68.4	69.3
2.3	70.2	71.0	72.0	72.9	73.8	74.7	75.6	76.5	77.5	78.4
2.4	79.3	80.3	81.2	82.2	83.2	84.1	85.1	86.1	87.1	88.1
2.5	89.1	90.1	91.1	92.1	93.1	94.1	95.1	96.2	97.2	98.2
2.6	99	100	101	102	104	105	106	107	108	109
2.7	110	111	112	113	115	116	117	118	119	120
2.8	121	123	124	125	126	127	129	130	131	132
2.9	133	135	136	137	138	140	141	142	143	145
3.0	146	147	149	150	151	153	154	155	157	158
3.1	159	161	162	163	165	166	168	169	170	172
3.2	173	175	176	177	179	180	182	183	185	186
3.3	188	189	191	192	194	195	197	198	200	201
3.4	203	204	206	208	209	211	212	214	216	217
3.5	219	220	222	224	225	227	229	230	232	234
3.6	235	237	239	241	242	244	246	247	249	251
3.7	253	254	256	258	260	262	263	265	267	269
3.8	271	273	274	276	278	280	282	284	286	287
3.9	289	291	293	295	297	299	301	303	305	307
4.0	309	311	313	315	317	319	321	323	325	327
4.1	329	331	333	335	337	339	341	343	345	347
4.2	349	351	354	356	358	360	362	364	366	368
4.3	371	373	375	377	379	381	384	386	388	390
4.4	392	395	397	399	401	404	406	408	410	413
4.5	415	417	419	422	424	426	428	431	433	435
4.6	438	440	442	445	447	449	452	454	456	459
4.7	461	463	466	468	471	473	475	478	480	482
4.8	485	487	490	492	495	497	499	502	504	507
4.9	509	512	514	516	519	521	524	526	529	531
5.0	534	536	539	541	544	546	548	551	553	556
	(cfs)	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*	*(cfs)*

Notes:
Stage refers to the staff plate reading (in units of feet and decimal feet).
Discharge in the volumetric flow rate (in units of cubic feet per second (cfs)).
This rating information will no longer be valid if changes to the streambed or channel occur, such as log jams.
This table provides an approximation of stream discharge for this gage. Balance Hydrologics staff conduct regular manual flow measurements which are used to revise the relationship between stage and discharge. The revised relationship is then applied to the stage record to produce a continuous flow record.
Flows greater than 260 cfs are extrapolated by extension of the stage discharge curve.

This station sponsored by the Department of Fish and Game, California Coastal Salmon Recovery Program

FIGURES

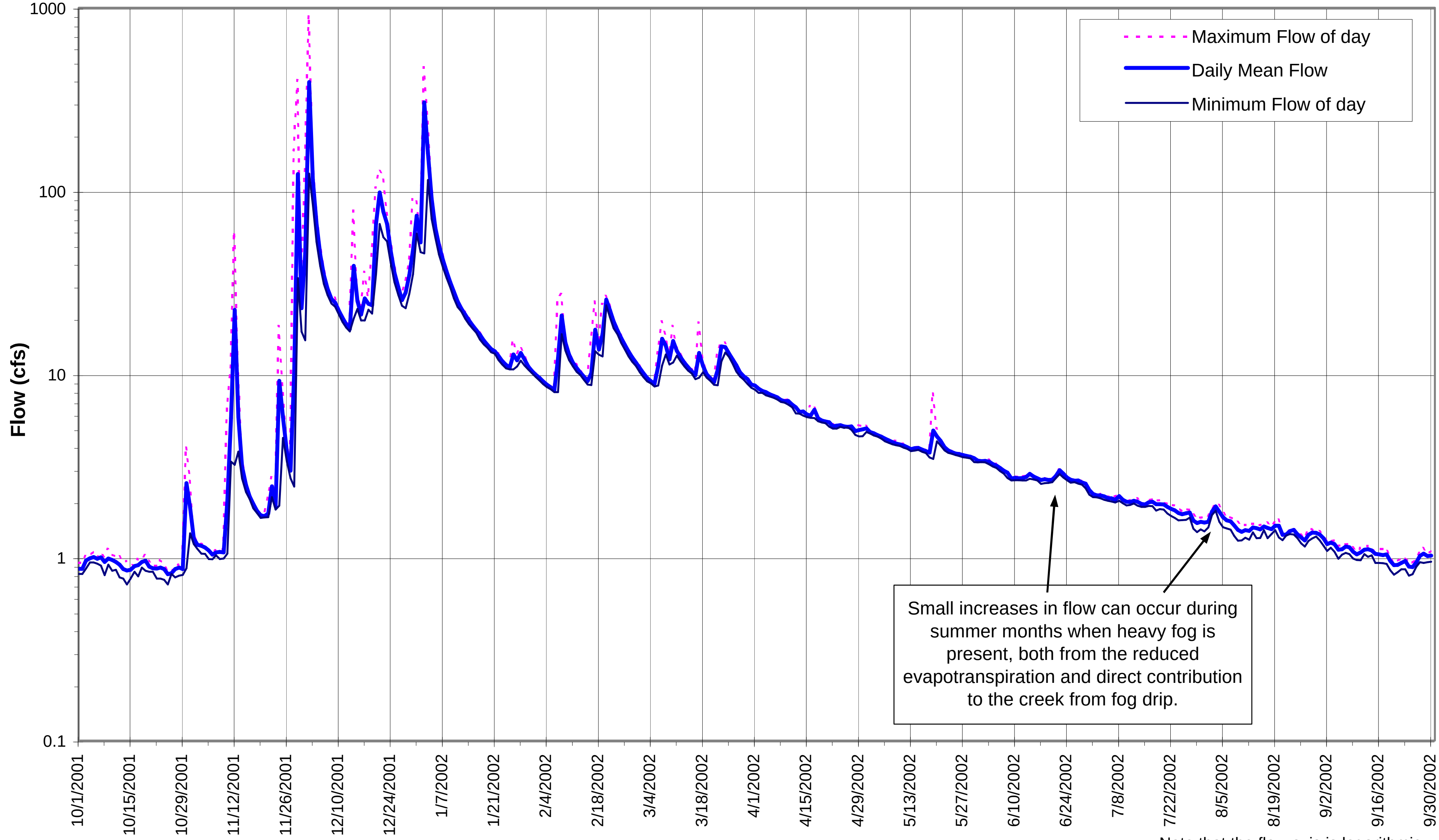


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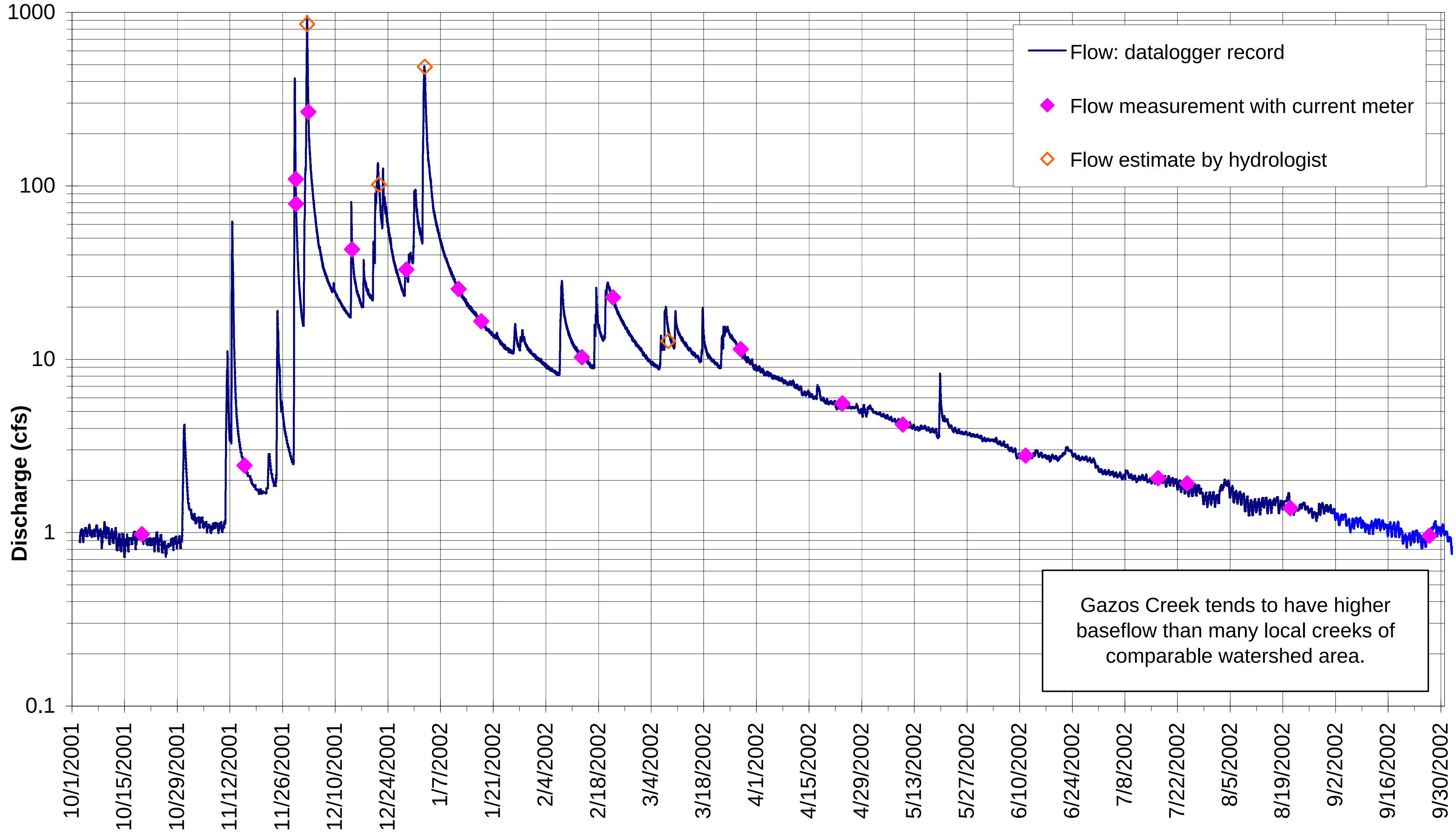
Figure 1. Daily flow hydrograph: Gazos Creek above Highway 1, water year 2002. One characteristic of Gazos Creek is high sustained baseflow through the dry season compared to many other creeks of similar watershed size. A significant point of diversion is a about 400 yards downstream from this station, but flow at this location does not appear to be affected.

most report figures.xls, Fig1

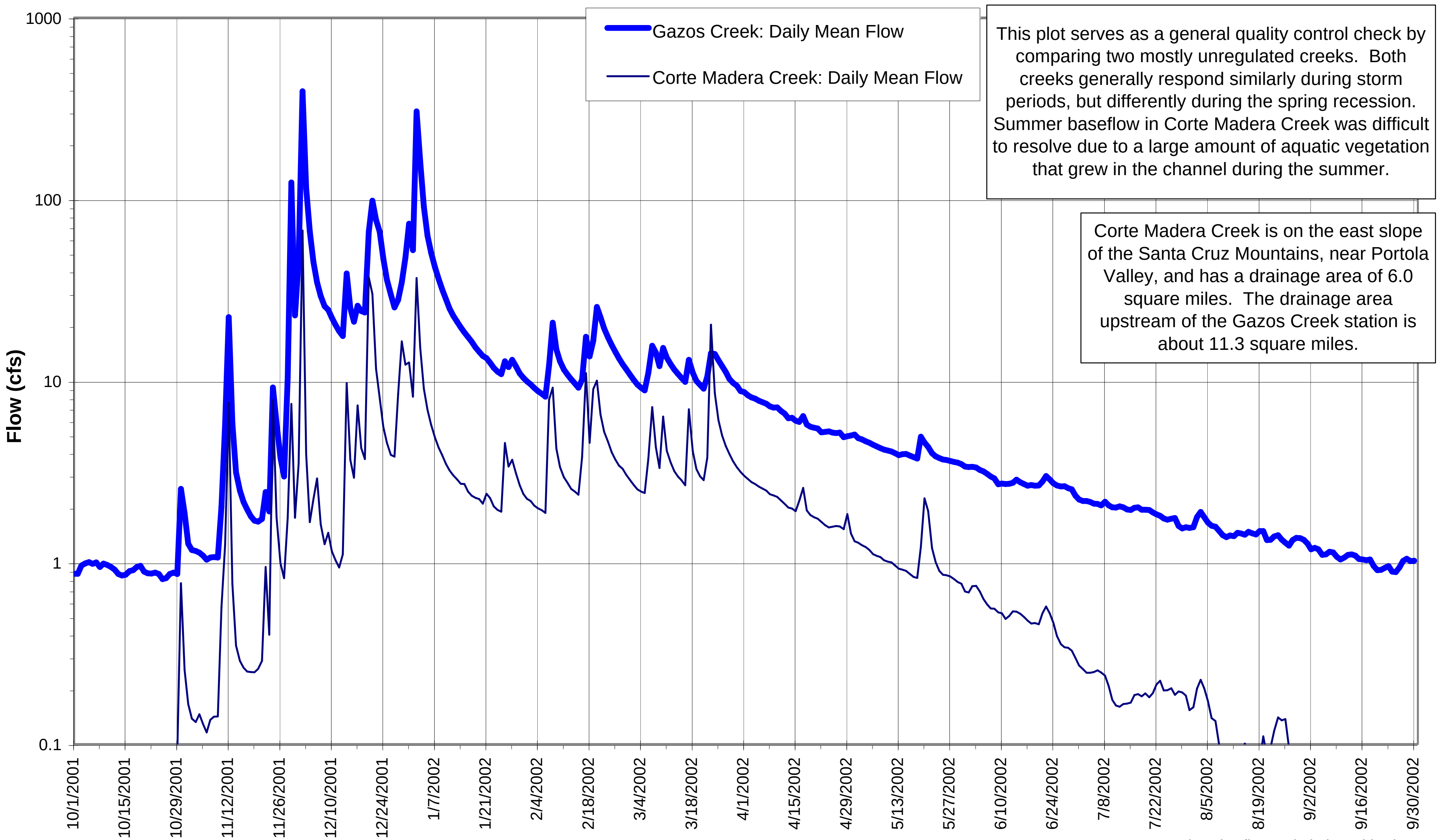
Gaging sponsored by the Department of Fish and Game, California Coastal Salmon Recovery Program



Balance Hydrologics, Inc.

Figure 2. **Streamflow hydrograph (15-minute data): Gazos Creek above Highway 1, water year 2002.** We estimated the two largest peak flows of the water year with the use of our surveyed cross-section profile and high-water marks.

200085 GZ_WY2002_Q.xls, 15flow



Note that the flow axis is logarithmic.

Balance Hydrologics, Inc.

Figure 3. Daily flow hydrographs: Gazos and Corte Madera Creeks, water year 2002.
The timing of each flow peaks coincides; Gazos has more flow total; Corte Madera Creek is flashier (higher peaks compared to baseflow). Gazos Creek has higher and more sustained baseflow through the dry season.

most report figures.xls, Fig3

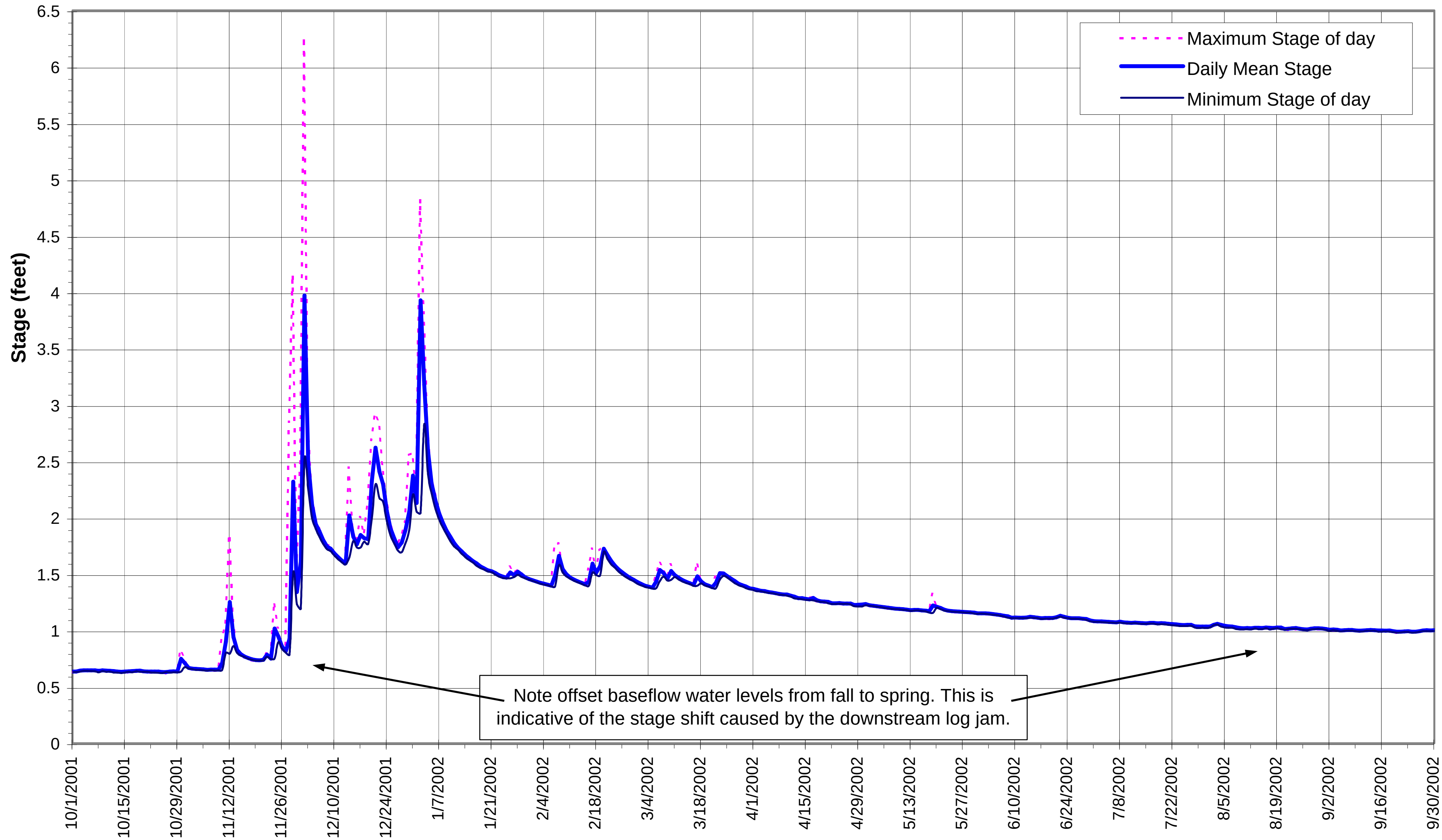


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Figure 4. Daily stage hydrograph: Gazos Creek above Highway 1, water year 2002. The stage record was affected by the log jam that formed about 100 feet downstream from the gaging site on or about Dec. 2, 2001.

Gaging sponsored by the Department of Fish and Game, California Coastal Salmon Recovery Program

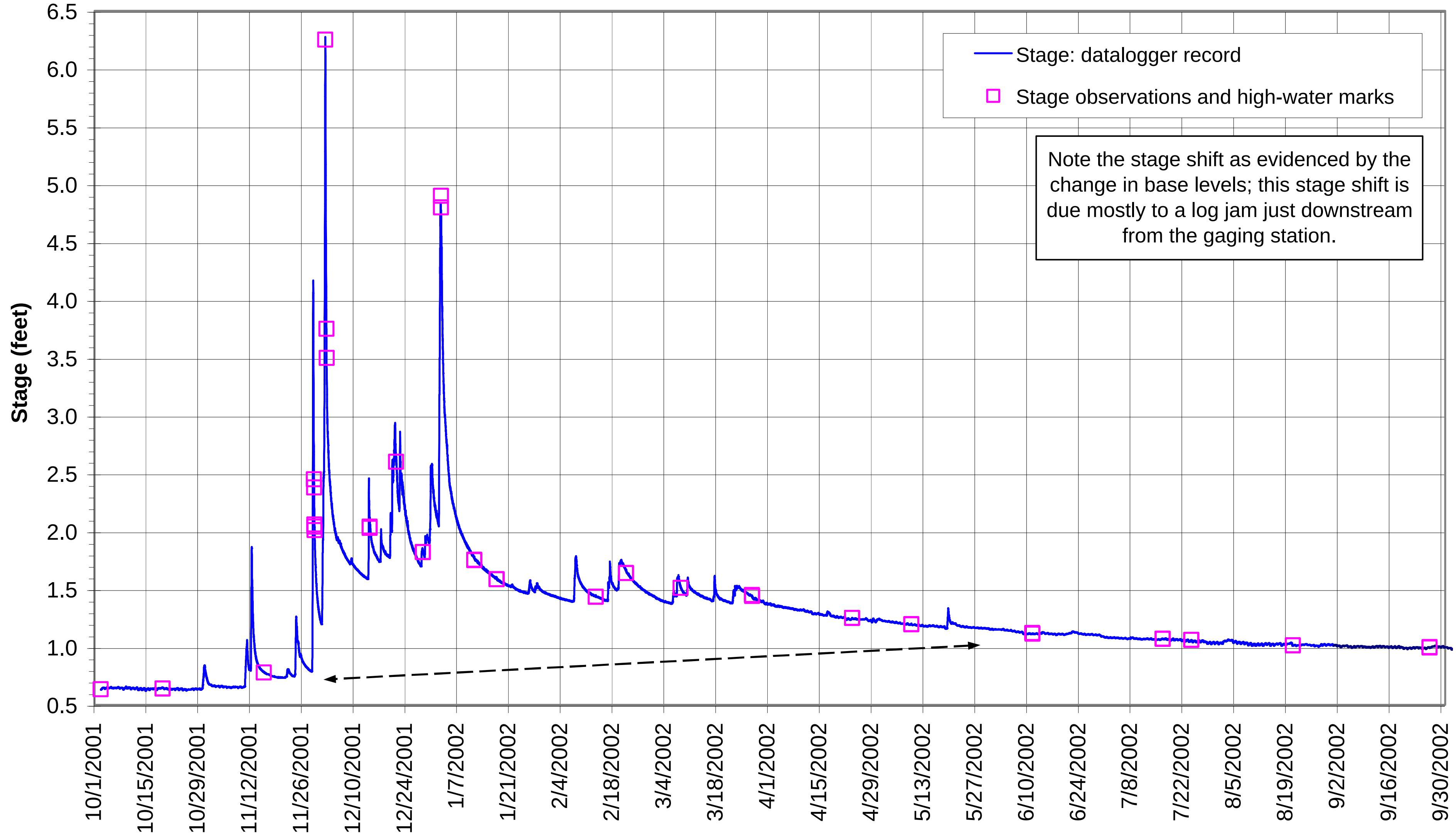

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Figure 5. Stage hydrograph (15-minute data): Gazos Creek upstream of Highway 1, water year 2002. Stage is the water level measured against the staff plate; stage is a relative datum and does not represent the absolute depth of water in the creek. High-water marks match the peaks in the stage record.

200085 GZ_WY2002_Q.xls, 15-stage

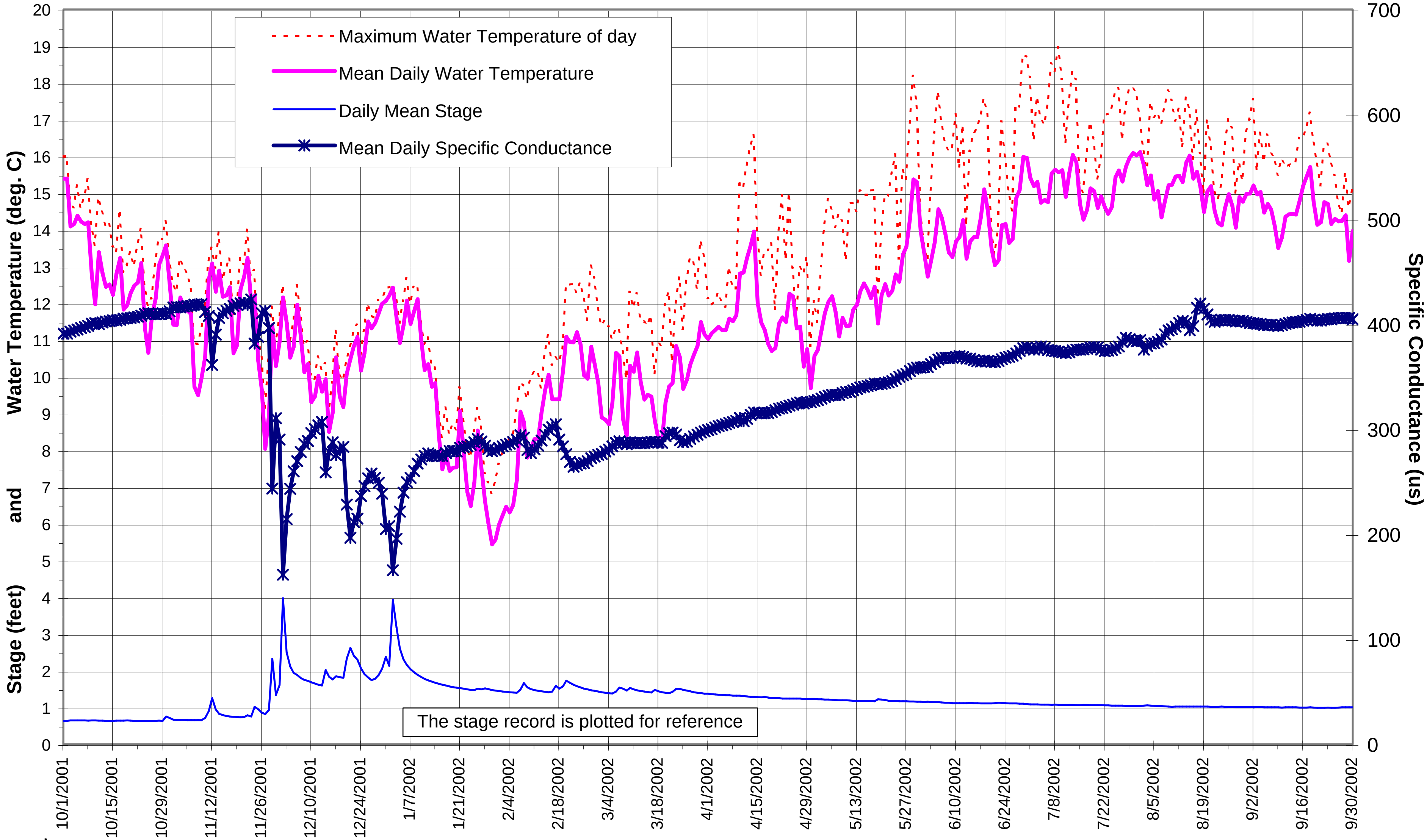

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Figure 6. Daily water temperature and specific conductance: Gazos Creek above Highway 1, water year 2002. Specific conductance is a measure of the amount of dissolved minerals in the water.

most report figures.xls, Fig6

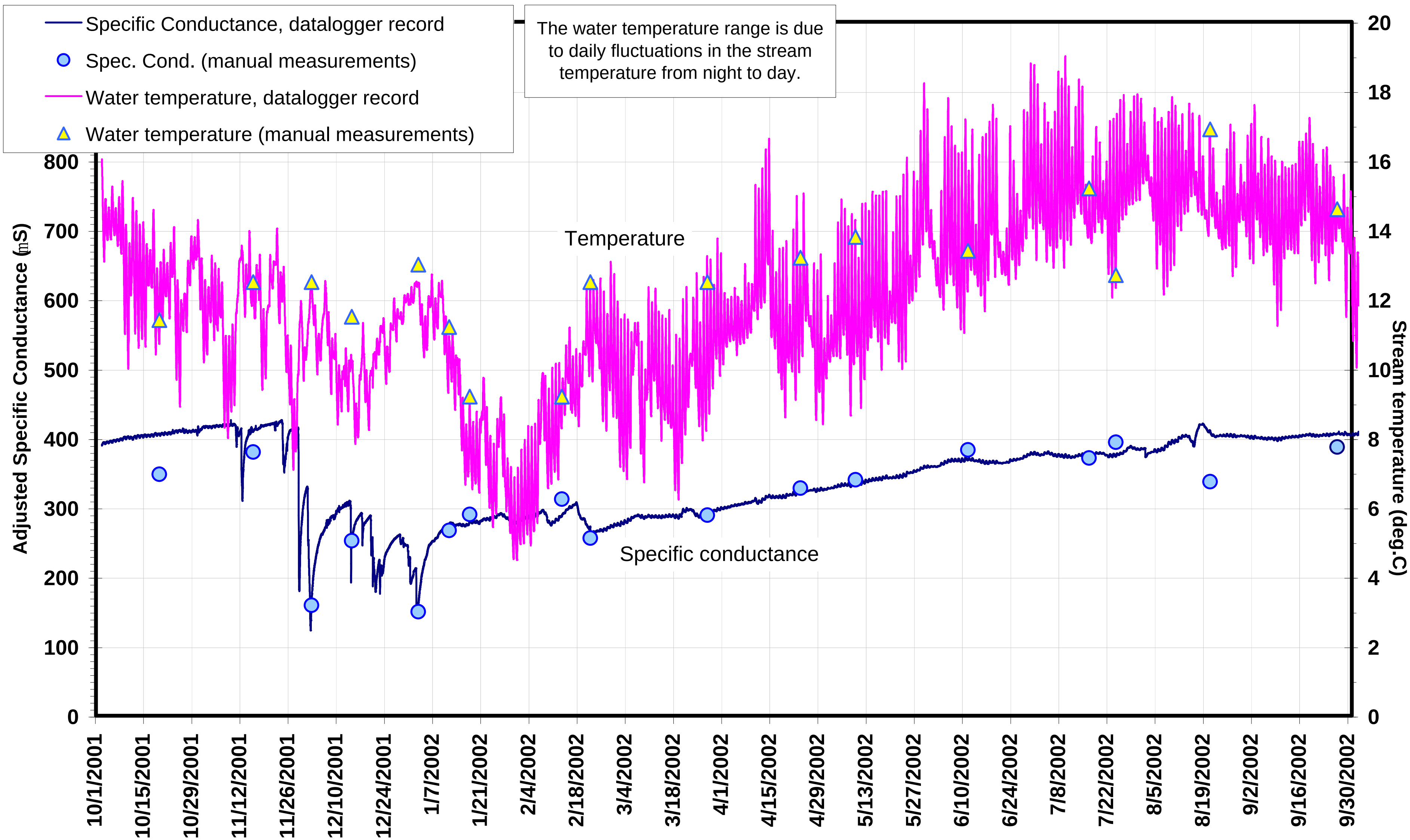

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Figure 7. Specific conductance and temperature: Gazos Creek above Highway 1, water year 2002. Specific conductance in Gazos Creek is lower than many area creeks, and does not respond as much to small rainfall amounts. The maximum water temperatures are among the lowest in the Santa Cruz Mountains.

200085 GZ_WY2002_Q.xls, SCT

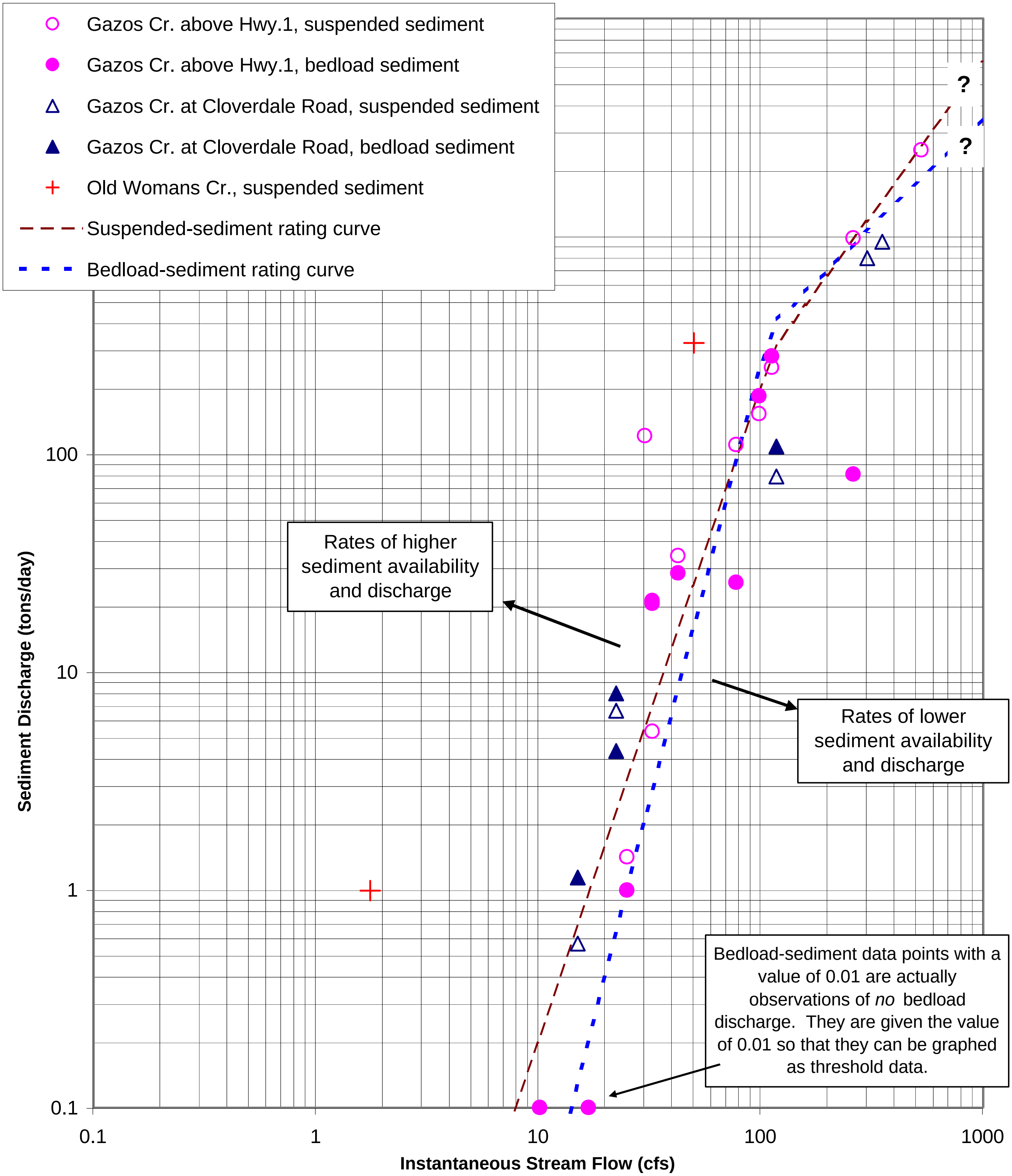

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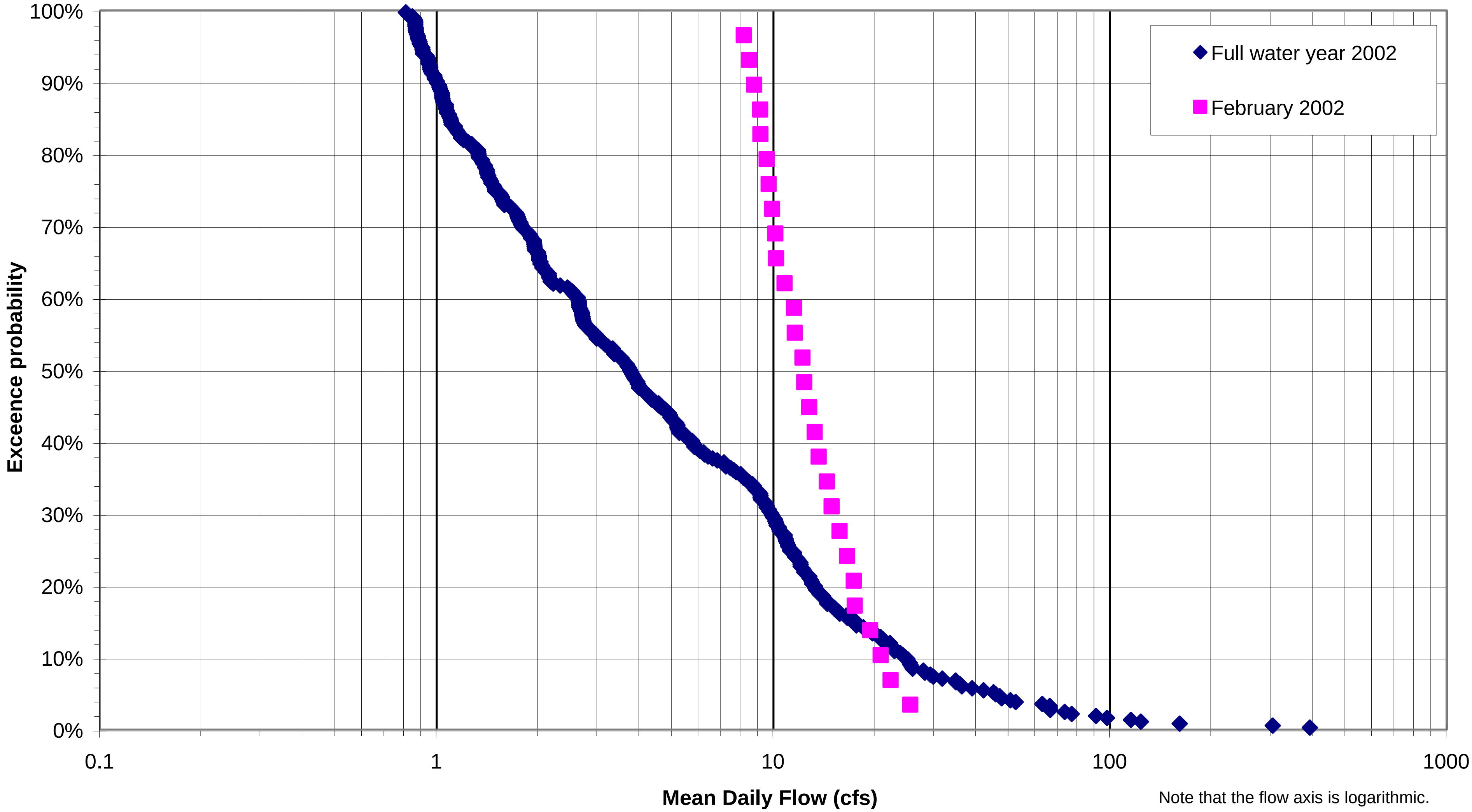
Figure 8. Measured sediment discharge rates and estimated sediment rating curves: Gazos Creek, water years 2001 and 2002. Note that Old Woman Creek has high suspended-sediment concentrations which influences downstream locations.

most report figures.xls, Fig8



Balance Hydrologics, Inc.

Figure 9. Daily flow exceedence plot: Gazos Creek above Highway 1, water year 2002.
Flow exceedence is becoming more commonly used in determining recommended diversion levels from creeks.